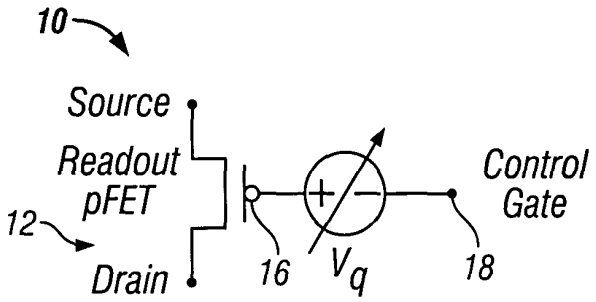

FIG. 1

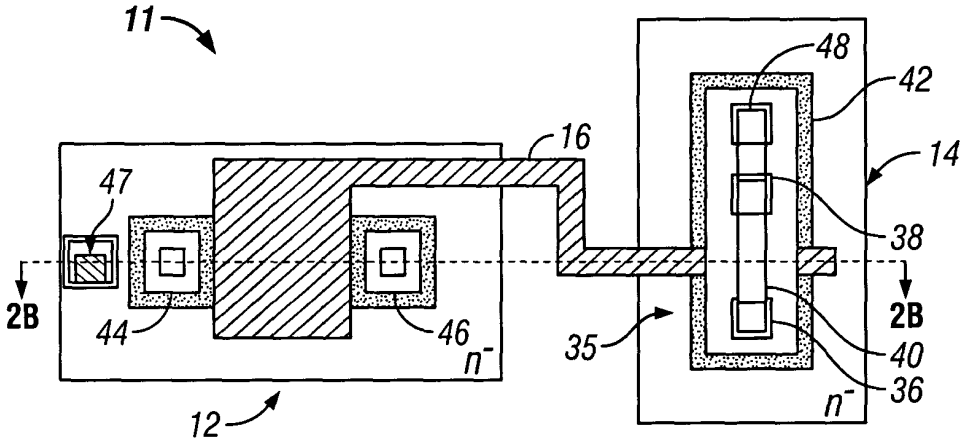

FIG. 2A

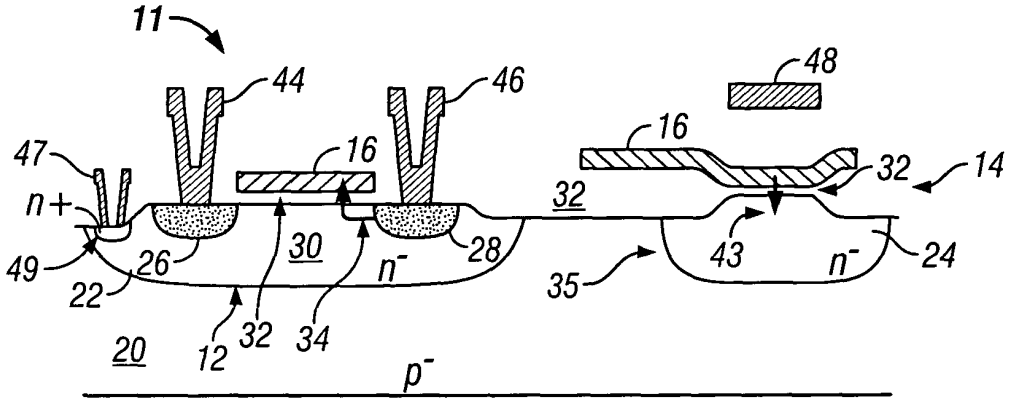

FIG. 2B

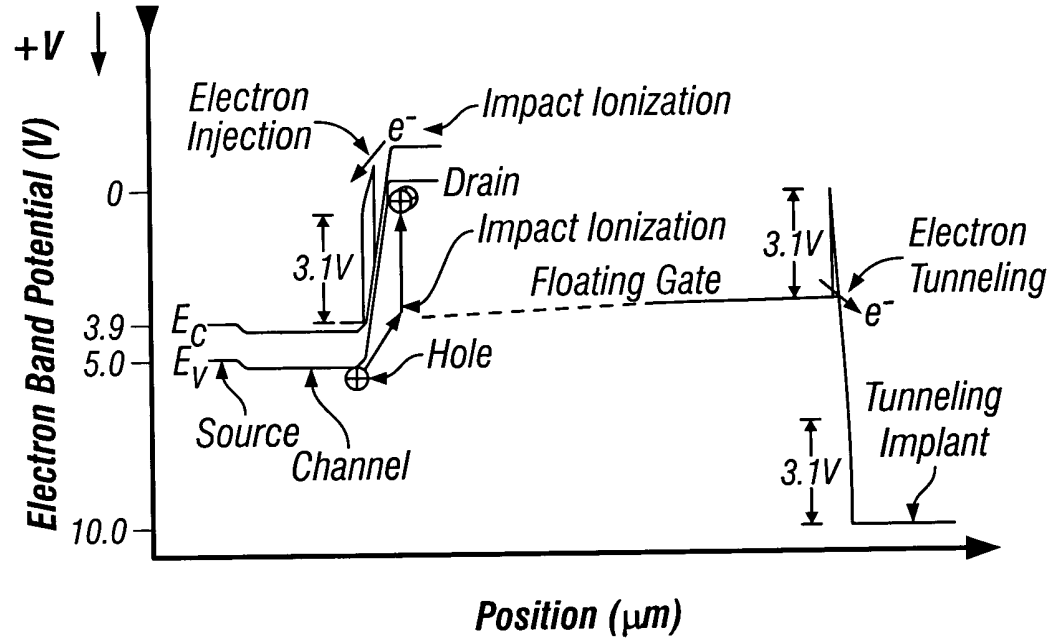
+V
Electron Band Potential (V)
0
3.9
5.0
10.0
Electron Injection
e-
Impact Ionization
Drain
3.1V
Impact Ionization
Floating Gate
3.1V
Electron Tunneling
e-
Ec
Ev
Hole
Source
Channel
Tunneling Implant
3.1V
Position (μm)

FIG. 2C

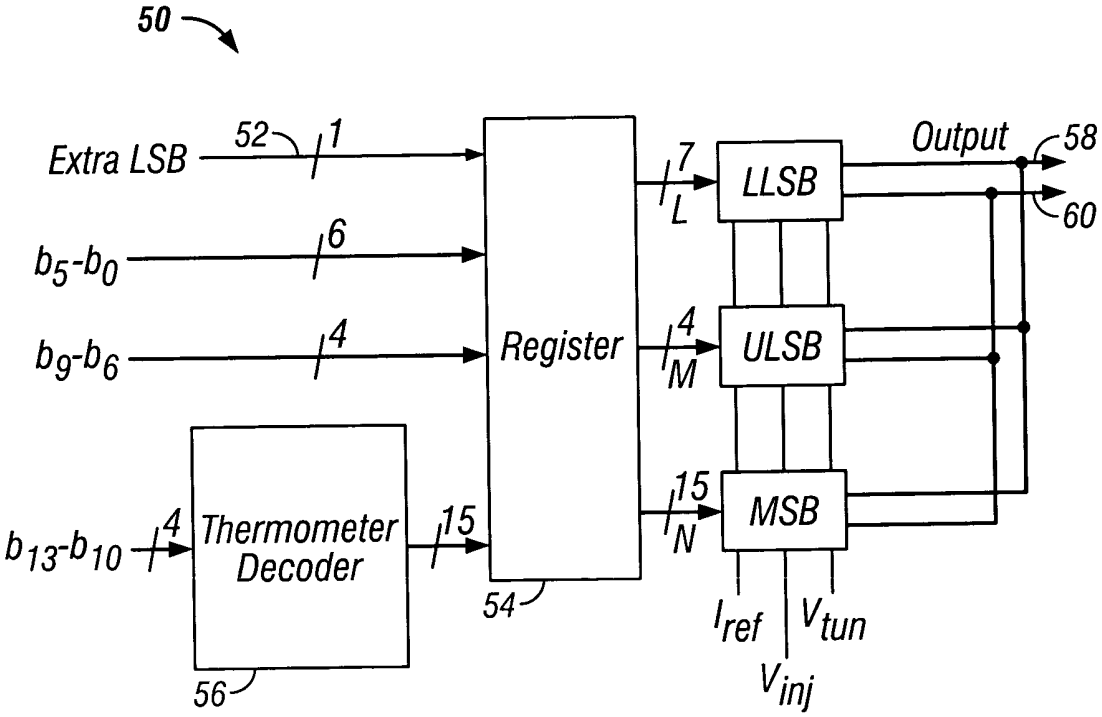
50
Extra LSB
52
1
b5-b0
6
b9-b6
4
b13-b10
4
Thermometer Decoder
15
Register
54
56
7
L
4
M
15
N
LLSB
ULSB
MSB
Output
58
60
Iref
Vtun
Vinj

FIG. 3

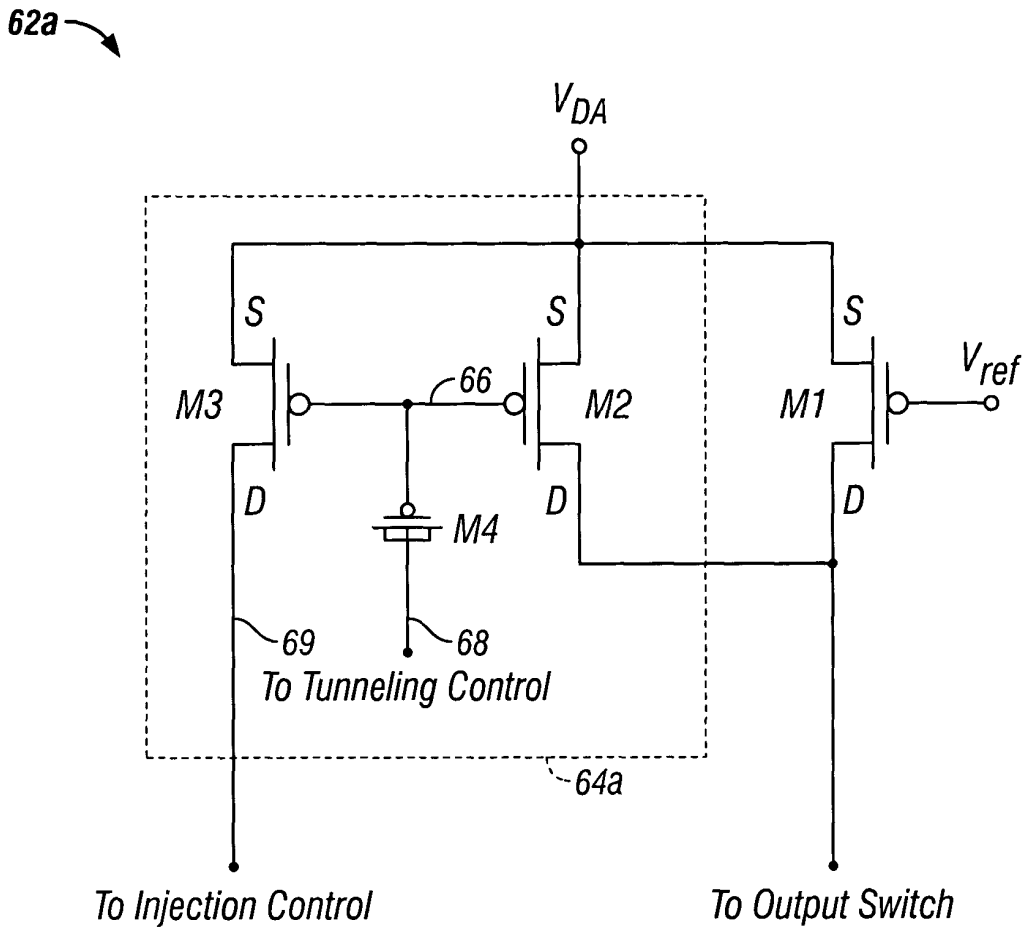
62a
V_{DA}
S
S
S
M3
66
M2
M1
V_{ref}
D
D
D
M4
69
68
To Tunneling Control
64a
To Injection Control
To Output Switch

FIG. 4A

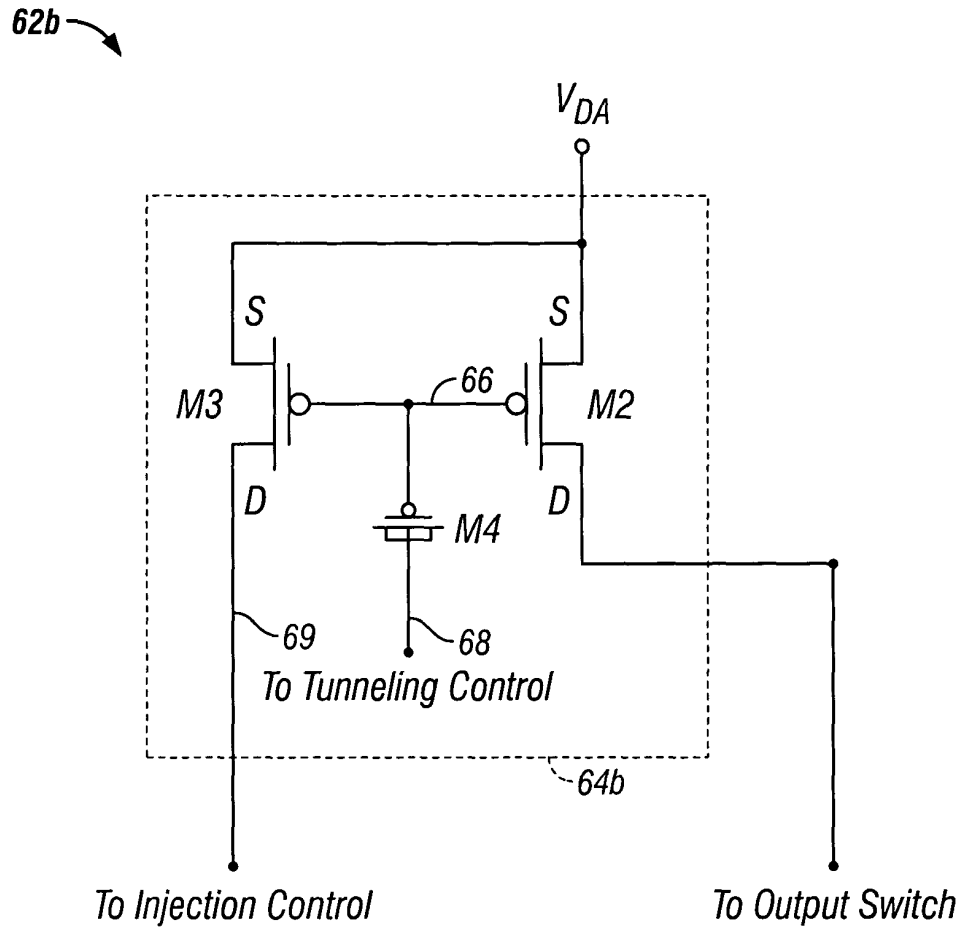
62b
V_{DA}
S
S
M3
66
M2
D
D
M4
69
68
To Tunneling Control
64b
To Injection Control
To Output Switch

FIG. 4B

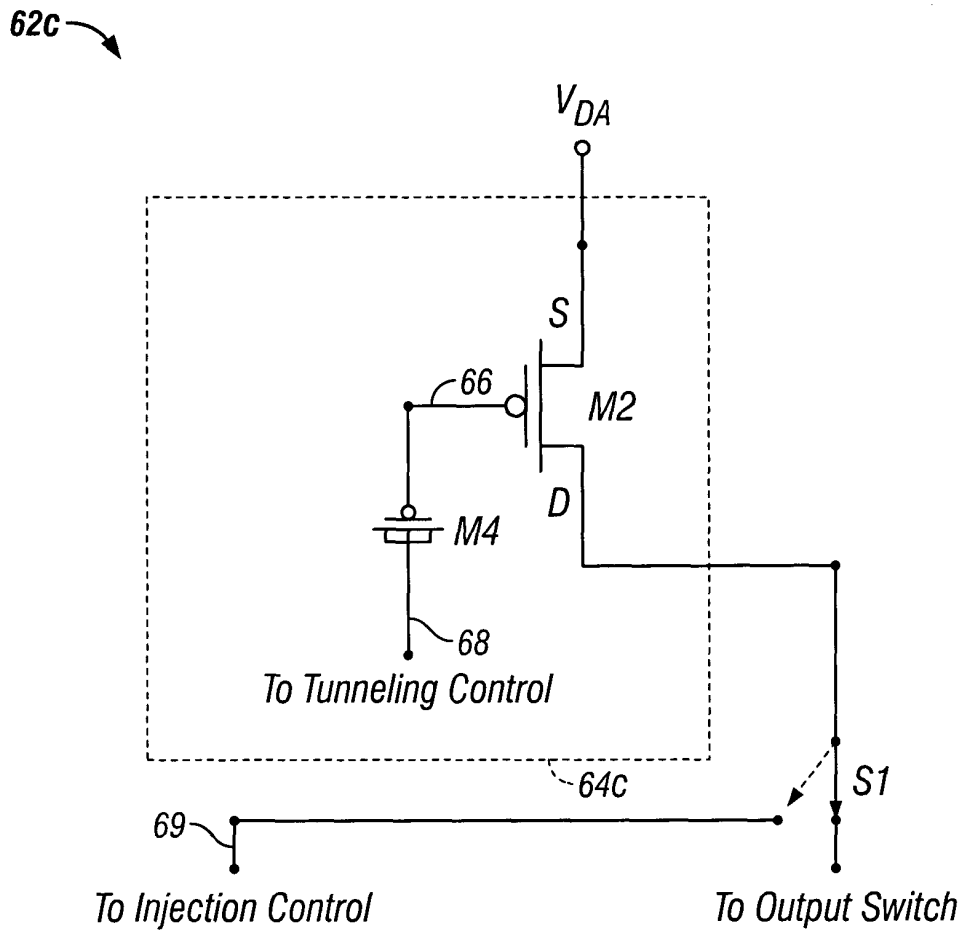
62c
V_{DA}
S
66
M2
D
M4
68
To Tunneling Control
64c
S1
69
To Injection Control
To Output Switch

FIG. 4C

```
Erase all trim current sources                                  70
For i := L to L + M - 1                                         72
Begin
        Apply codeword 2^i-1+LSB
        target := DAC output
        Apply codeword 2^I
        If output greater than target
                Inject on global current regulator and start again
        While output less than target
                Inject on trim current source i
End

For j := 1 to 2^N-1                                             74
Begin
        Apply codeword 2^L+M-1 + LSB + (j -1)*2^L+M
        target := DAC output
        Apply codeword j*2^L+M
        If output greater than target
                Inject on global current regulator and start again
        While output less than target
                Inject on trim current source L + M + (j-1)
End
```

FIG. 5

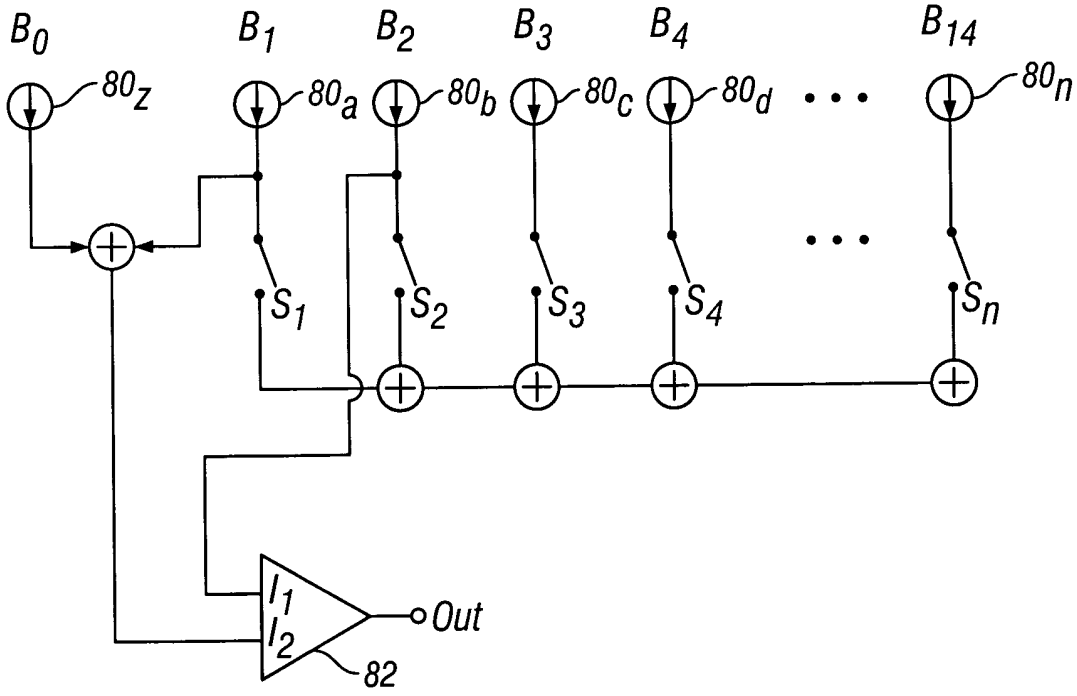
B0
B1
B2
B3
B4
B14
80z
80a
80b
80c
80d
80n
S1
S2
S3
S4
Sn
I1
I2
Out
82

FIG. 6A

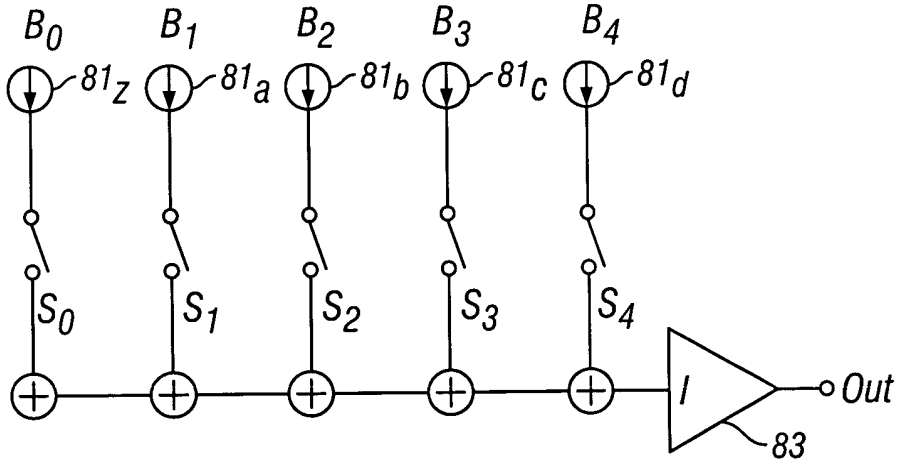
B0
B1
B2
B3
B4
81z
81a
81b
81c
81d
S0
S1
S2
S3
S4
I
Out
83

FIG. 6B

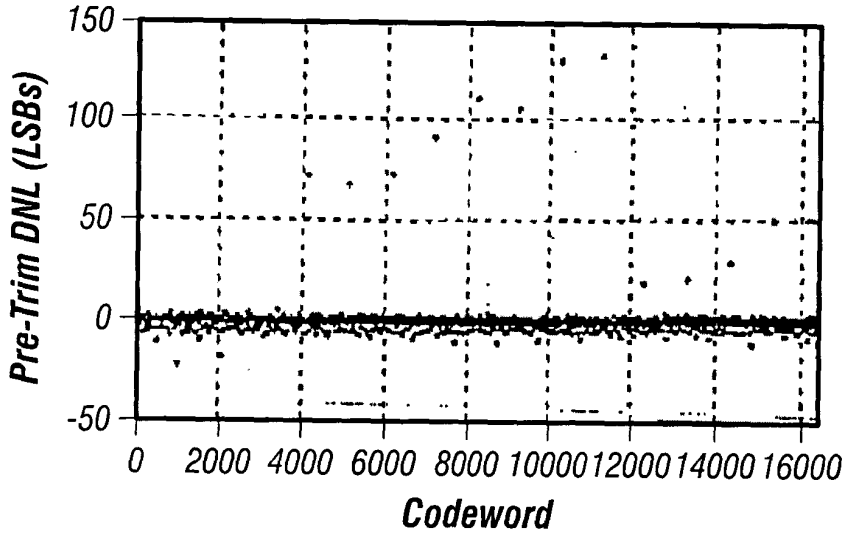
150
100
50
0
-50
Pre-Trim DNL (LSBs)
0
2000
4000
6000
8000
10000
12000
14000
16000
Codeword

FIG. 7A

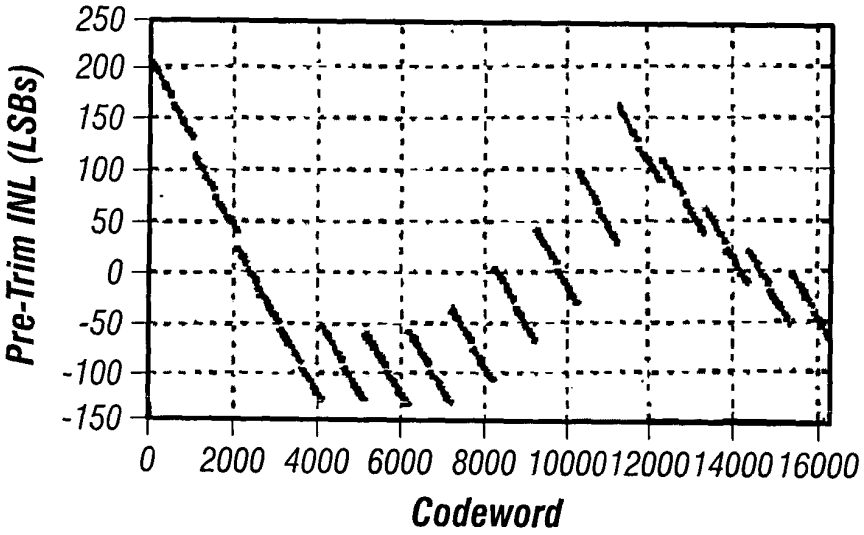
250
200
150
100
50
0
-50
-100
-150
Pre-Trim INL (LSBs)
0
2000
4000
6000
8000
10000
12000
14000
16000
Codeword

FIG. 7B

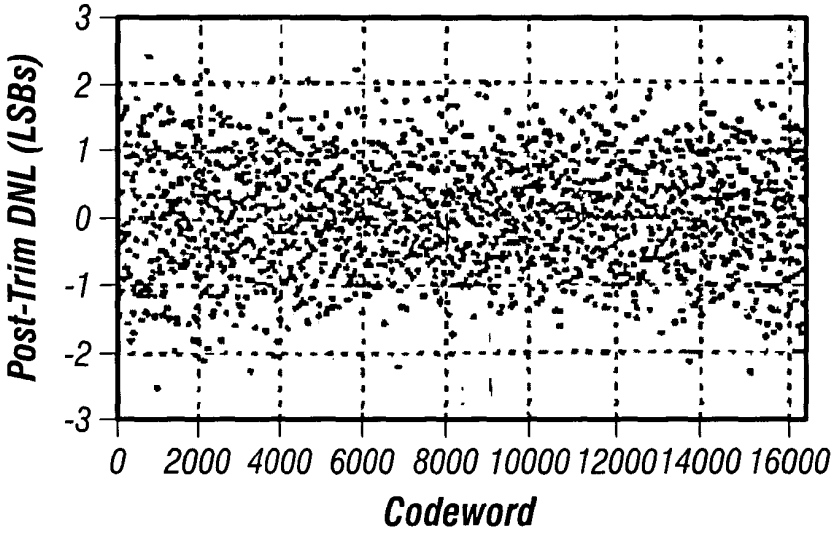
Post-Trim DNL (LSBs)
3
2
1
0
-1
-2
-3
0
2000
4000
6000
8000
10000
12000
14000
16000
Codeword

FIG. 7C

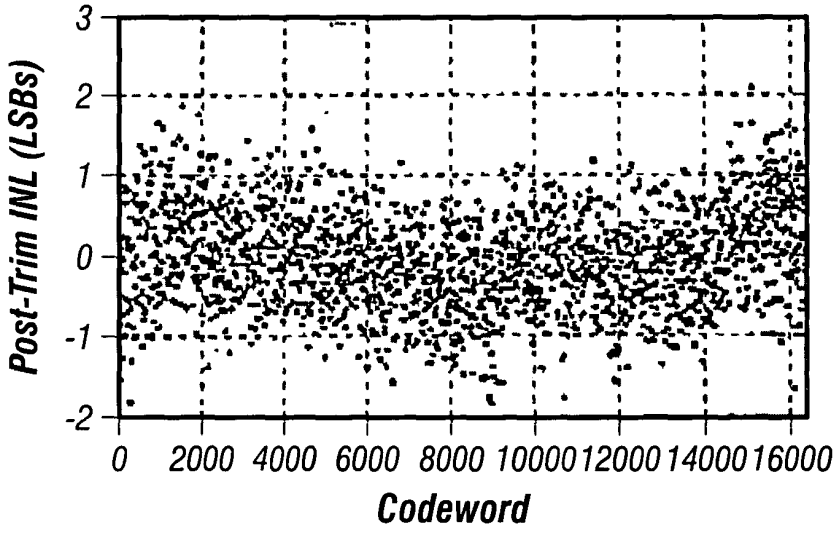
Post-Trim INL (LSBs)
3
2
1
0
-1
-2
0
2000
4000
6000
8000
10000
12000
14000
16000
Codeword

FIG. 7D